

1 **WHAT IS CLAIMED IS:**

- 2
- 3 1. An isolated deallergenized acyl lipid hydrolase protein comprising SEQ ID NO:2
4 modified in one or more of the following regions, or SEQ ID NO:7 modified in
5 one or more of the following regions:

6 positions 104-113 of SEQ ID NO:2 or positions 85-94 of SEQ ID NO:7;
7 positions 128-137 of SEQ ID NO:2 or positions 109-118 of SEQ ID NO:7;
8 positions 184-197 of SEQ ID NO:2 or positions 165-178 of SEQ ID NO:7;
9 position 202 of SEQ ID NO:2 or position 183 of SEQ ID NO:7;
10 positions 264-277 of SEQ ID NO:2 or positions 245-258 of SEQ ID NO:7;
11 positions 316-325 of SEQ ID NO:2 or positions 297-306 of SEQ ID NO:7; and
12 positions 360-377 of SEQ ID NO:2 or positions 341-358 of SEQ ID NO:7;

13 wherein:

14 SEQ ID NO:2 or SEQ ID NO:7 is modified by replacing one or more
15 amino acids in the regions with alanine, glutamic acid,
16 phenylalanine, proline, serine, or glutamine; and
17 the modified protein displays reduced binding to anti-acyl lipid hydrolase
18 antibodies with respect to the binding of unmodified acyl lipid
19 hydrolase protein to the anti- acyl lipid hydrolase antibodies.

- 20 2. An isolated deallergenized acyl lipid hydrolase protein comprising SEQ ID NO:2
21 modified by one or more of the following changes or SEQ ID NO:7 modified by
22 one or more of the following changes:

23 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
24 ID NO:7 is replaced with phenylalanine or alanine;

25 the isoleucine corresponding to position 113 of SEQ ID NO:2 or position 94 of
26 SEQ ID NO:7 is replaced with alanine;

27 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
28 SEQ ID NO:7 is replaced with phenylalanine or alanine;

29 the lysine corresponding to position 137 of SEQ ID NO:2 or position 118 of SEQ
30 ID NO:7 is replaced with alanine;

1 the serine corresponding to position 184 of SEQ ID NO:2 or position 165 of SEQ
2 ID NO:7 is replaced with alanine;
3 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
4 SEQ ID NO:7 is replaced with phenylalanine or alanine;
5 the alanine corresponding to position 188 of SEQ ID NO:2 or position 169 of
6 SEQ ID NO:7 is replaced with serine;
7 the threonine corresponding to position 192 of SEQ ID NO:2 or position 173 of
8 SEQ ID NO:7 is replaced with alanine or proline;
9 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
10 SEQ ID NO:7 is replaced with phenylalanine or alanine;
11 the asparagine at position 202 of SEQ ID NO:2 or position 183 of SEQ ID NO:7
12 is replaced with glutamine;
13 the lysine corresponding to position 268 of SEQ ID NO:2 or position 249 of SEQ
14 ID NO:7 is replaced with alanine or glutamic acid;
15 the threonine corresponding to position 269 of SEQ ID NO:2 or position 250 of
16 SEQ ID NO:7 is replaced with alanine;
17 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
18 SEQ ID NO:7 is replaced with phenylalanine or alanine;
19 the lysine corresponding to position 273 of SEQ ID NO:2 or position 254 of SEQ
20 ID NO:7 is replaced with alanine;
21 the lysine corresponding to position 313 of SEQ ID NO:2 or position 294 of SEQ
22 ID NO:7 is replaced with glutamic acid;
23 the asparagine corresponding to position 314 of SEQ ID NO:2 or position 295 of
24 SEQ ID NO:7 is replaced with alanine;
25 the asparagine corresponding to position 315 of SEQ ID NO:2 or position 296 of
26 SEQ ID NO:7 is replaced with alanine;
27 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
28 SEQ ID NO:7 is replaced with phenylalanine or alanine;
29 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
30 SEQ ID NO:7 is replaced with phenylalanine;

1 the lysine corresponding to position 367 of SEQ ID NO:2 or position 348 of SEQ
2 ID NO:7 is replaced with alanine;
3 the arginine corresponding to position 368 of SEQ ID NO:2 or position 349 of
4 SEQ ID NO:7 is replaced with alanine;
5 the phenylalanine corresponding to position 369 of SEQ ID NO:2 or position 350
6 of SEQ ID NO:7 is replaced with alanine;
7 the lysine corresponding to position 371 of SEQ ID NO:2 or position 352 of SEQ
8 ID NO:7 is replaced with alanine;
9 the leucine corresponding to position 372 of SEQ ID NO:2 or position 353 of
10 SEQ ID NO:7 is replaced with alanine; and
11 the leucine corresponding to position 373 of SEQ ID NO:2 or position 354 of
12 SEQ ID NO:7 is replaced with alanine.

13 3. The deallergenized acyl lipid hydrolase protein of claim 2, wherein SEQ ID NO:2
14 is modified by the following changes or SEQ ID NO:7 is modified by the
15 following changes:
16 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
17 ID NO:7 is replaced with phenylalanine;
18 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
19 SEQ ID NO:7 is replaced with phenylalanine;
20 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
21 SEQ ID NO:7 is replaced with phenylalanine;
22 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
23 SEQ ID NO:7 is replaced with phenylalanine;
24 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
25 SEQ ID NO:7 is replaced with phenylalanine;
26 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
27 SEQ ID NO:7 is replaced with phenylalanine; and
28 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
29 SEQ ID NO:7 is replaced with phenylalanine.

- 1 4. The deallergenized acyl lipid hydrolase protein of claim 2, wherein SEQ ID NO:2
2 is modified by the following changes or SEQ ID NO:7 is modified by the
3 following changes:
4 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
5 SEQ ID NO:7 is replaced with phenylalanine;
6 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
7 SEQ ID NO:7 is replaced with phenylalanine;
8 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
9 SEQ ID NO:7 is replaced with phenylalanine;
10 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
11 SEQ ID NO:7 is replaced with phenylalanine; and
12 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
13 SEQ ID NO:7 is replaced with phenylalanine.
- 14 5. An isolated nucleic acid molecule segment comprising a structural nucleic acid
15 sequence, the structural nucleic acid sequence encoding SEQ ID NO:2 modified
16 in one or more of the following regions, or SEQ ID NO:7 modified in one or more
17 of the following regions:
18 positions 104-113 of SEQ ID NO:2 or positions 85-94 of SEQ ID NO:7;
19 positions 128-137 of SEQ ID NO:2 or positions 109-118 of SEQ ID NO:7;
20 positions 184-197 of SEQ ID NO:2 or positions 165-178 of SEQ ID NO:7;
21 position 202 of SEQ ID NO:2 or position 183 of SEQ ID NO:7;
22 positions 264-277 of SEQ ID NO:2 or positions 245-258 of SEQ ID NO:7;
23 positions 316-325 of SEQ ID NO:2 or positions 297-306 of SEQ ID NO:7; and
24 positions 360-377 of SEQ ID NO:2 or positions 341-358 of SEQ ID NO:7;
25 wherein:
26 SEQ ID NO:2 or SEQ ID NO:7 is modified by replacing one or more
27 amino acids in the regions with alanine, glutamic acid,
28 phenylalanine, proline, serine, or glutamine; and
29 the modified protein displays reduced binding to anti- acyl lipid hydrolase
30 antibodies with respect to the binding of unmodified acyl lipid
31 hydrolase protein to the anti- acyl lipid hydrolase antibodies.

1 6. An isolated nucleic acid molecule segment comprising a structural nucleic acid
2 sequence, the structural nucleic acid sequence encoding SEQ ID NO:2 modified
3 by one or more of the following changes or encoding SEQ ID NO:7 modified by
4 one or more of the following changes:
5 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
6 ID NO:7 is replaced with phenylalanine or alanine;
7 the isoleucine corresponding to position 113 of SEQ ID NO:2 or position 94 of
8 SEQ ID NO:7 is replaced with alanine;
9 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
10 SEQ ID NO:7 is replaced with phenylalanine or alanine;
11 the lysine corresponding to position 137 of SEQ ID NO:2 or position 118 of SEQ
12 ID NO:7 is replaced with alanine;
13 the serine corresponding to position 184 of SEQ ID NO:2 or position 165 of SEQ
14 ID NO:7 is replaced with alanine;
15 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
16 SEQ ID NO:7 is replaced with phenylalanine or alanine;
17 the alanine corresponding to position 188 of SEQ ID NO:2 or position 169 of
18 SEQ ID NO:7 is replaced with serine;
19 the threonine corresponding to position 192 of SEQ ID NO:2 or position 173 of
20 SEQ ID NO:7 is replaced with alanine or proline;
21 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
22 SEQ ID NO:7 is replaced with phenylalanine or alanine;
23 the asparagine corresponding to position 202 of SEQ ID NO:2 or position 183 of
24 SEQ ID NO:7 is replaced with glutamine;
25 the lysine corresponding to position 268 of SEQ ID NO:2 or position 249 of SEQ
26 ID NO:7 is replaced with alanine or glutamic acid;
27 the threonine corresponding to position 269 of SEQ ID NO:2 or position 250 of
28 SEQ ID NO:7 is replaced with alanine;
29 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
30 SEQ ID NO:7 is replaced with phenylalanine or alanine;

1 the lysine corresponding to position 273 of SEQ ID NO:2 or position 254 of SEQ
2 ID NO:7 is replaced with alanine;
3 the lysine corresponding to position 313 of SEQ ID NO:2 or position 294 of SEQ
4 ID NO:7 is replaced with glutamic acid;
5 the asparagine corresponding to position 314 of SEQ ID NO:2 or position 295 of
6 SEQ ID NO:7 is replaced with alanine;
7 the asparagine corresponding to position 315 of SEQ ID NO:2 or position 296 of
8 SEQ ID NO:7 is replaced with alanine;
9 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
10 SEQ ID NO:7 is replaced with phenylalanine or alanine;
11 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
12 SEQ ID NO:7 is replaced with phenylalanine;
13 the lysine corresponding to position 367 of SEQ ID NO:2 or position 348 of SEQ
14 ID NO:7 is replaced with alanine;
15 the arginine corresponding to position 368 of SEQ ID NO:2 or position 349 of
16 SEQ ID NO:7 is replaced with alanine;
17 the phenylalanine corresponding to position 369 of SEQ ID NO:2 or position 350
18 of SEQ ID NO:7 is replaced with alanine;
19 the lysine corresponding to position 371 of SEQ ID NO:2 or position 352 of SEQ
20 ID NO:7 is replaced with alanine;
21 the leucine corresponding to position 372 of SEQ ID NO:2 or position 353 of
22 SEQ ID NO:7 is replaced with alanine; and
23 the leucine corresponding to position 373 of SEQ ID NO:2 or position 354 of
24 SEQ ID NO:7 is replaced with alanine.
25 7. The nucleic acid molecule segment of claim 6, wherein SEQ ID NO:2 is modified
26 by the following changes or SEQ ID NO:7 is modified by the following changes
27 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
28 ID NO:7 is replaced with phenylalanine;
29 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
30 SEQ ID NO:7 is replaced with phenylalanine;

1 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
2 SEQ ID NO:7 is replaced with phenylalanine;
3 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
4 SEQ ID NO:7 is replaced with phenylalanine;
5 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
6 SEQ ID NO:7 is replaced with phenylalanine;
7 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
8 SEQ ID NO:7 is replaced with phenylalanine; and
9 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
10 SEQ ID NO:7 is replaced with phenylalanine.

11 8. The nucleic acid molecule segment of claim 6, wherein SEQ ID NO:2 is modified
12 by the following changes or SEQ ID NO:7 is modified by the following changes
13 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
14 SEQ ID NO:7 is replaced with phenylalanine;
15 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
16 SEQ ID NO:7 is replaced with phenylalanine;
17 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
18 SEQ ID NO:7 is replaced with phenylalanine;
19 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
20 SEQ ID NO:7 is replaced with phenylalanine; and
21 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
22 SEQ ID NO:7 is replaced with phenylalanine.

23 9. A recombinant host cell comprising a structural nucleic acid sequence encoding
24 SEQ ID NO:2 modified in one or more of the following regions, or SEQ ID NO:7
25 modified in one or more of the following regions:
26 positions 104-113 of SEQ ID NO:2 or positions 85-94 of SEQ ID NO:7;
27 positions 128-137 of SEQ ID NO:2 or positions 109-118 of SEQ ID NO:7;
28 positions 184-197 of SEQ ID NO:2 or positions 165-178 of SEQ ID NO:7;
29 position 202 of SEQ ID NO:2 or position 183 of SEQ ID NO:7;
30 positions 264-277 of SEQ ID NO:2 or positions 245-258 of SEQ ID NO:7;
31 positions 316-325 of SEQ ID NO:2 or positions 297-306 of SEQ ID NO:7; and

1 positions 360-377 of SEQ ID NO:2 or positions 341-358 of SEQ ID NO:7;
2 wherein:
3 SEQ ID NO:2 or SEQ ID NO:7 is modified by replacing one or more
4 amino acids in the regions with alanine, glutamic acid,
5 phenylalanine, proline, serine, or glutamine; and
6 the modified protein displays reduced binding to anti- acyl lipid hydrolase
7 antibodies with respect to the binding of unmodified acyl lipid
8 hydrolase protein to the anti- acyl lipid hydrolase antibodies.

9 10. A recombinant host cell comprising a structural nucleic acid sequence encoding
10 SEQ ID NO:2 modified by one or more of the following changes or encoding
11 SEQ ID NO:7 modified by one or more of the following changes:
12 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
13 ID NO:7 is replaced with phenylalanine or alanine;
14 the isoleucine corresponding to position 113 of SEQ ID NO:2 or position 94 of
15 SEQ ID NO:7 is replaced with alanine;
16 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
17 SEQ ID NO:7 is replaced with phenylalanine or alanine;
18 the lysine corresponding to position 137 of SEQ ID NO:2 or position 118 of SEQ
19 ID NO:7 is replaced with alanine;
20 the serine corresponding to position 184 of SEQ ID NO:2 or position 165 of SEQ
21 ID NO:7 is replaced with alanine;
22 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
23 SEQ ID NO:7 is replaced with phenylalanine or alanine;
24 the alanine corresponding to position 188 of SEQ ID NO:2 or position 169 of
25 SEQ ID NO:7 is replaced with serine;
26 the threonine corresponding to position 192 of SEQ ID NO:2 or position 173 of
27 SEQ ID NO:7 is replaced with alanine or proline;
28 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
29 SEQ ID NO:7 is replaced with phenylalanine or alanine;
30 the asparagine corresponding to position 202 of SEQ ID NO:2 or position 183 of
31 SEQ ID NO:7 is replaced with glutamine;

1 the lysine corresponding to position 268 of SEQ ID NO:2 or position 249 of SEQ
2 ID NO:7 is replaced with alanine or glutamic acid;
3 the threonine corresponding to position 269 of SEQ ID NO:2 or position 250 of
4 SEQ ID NO:7 is replaced with alanine;
5 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
6 SEQ ID NO:7 is replaced with phenylalanine or alanine;
7 the lysine corresponding to position 273 of SEQ ID NO:2 or position 254 of SEQ
8 ID NO:7 is replaced with alanine;
9 the lysine corresponding to position 313 of SEQ ID NO:2 or position 294 of SEQ
10 ID NO:7 is replaced with glutamic acid;
11 the asparagine corresponding to position 314 of SEQ ID NO:2 or position 295 of
12 SEQ ID NO:7 is replaced with alanine;
13 the asparagine corresponding to position 315 of SEQ ID NO:2 or position 296 of
14 SEQ ID NO:7 is replaced with alanine;
15 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
16 SEQ ID NO:7 is replaced with phenylalanine or alanine;
17 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
18 SEQ ID NO:7 is replaced with phenylalanine;
19 the lysine corresponding to position 367 of SEQ ID NO:2 or position 348 of SEQ
20 ID NO:7 is replaced with alanine;
21 the arginine corresponding to position 368 of SEQ ID NO:2 or position 349 of
22 SEQ ID NO:7 is replaced with alanine;
23 the phenylalanine corresponding to position 369 of SEQ ID NO:2 or position 350
24 of SEQ ID NO:7 is replaced with alanine;
25 the lysine corresponding to position 371 of SEQ ID NO:2 or position 352 of SEQ
26 ID NO:7 is replaced with alanine;
27 the leucine corresponding to position 372 of SEQ ID NO:2 or position 353 of
28 SEQ ID NO:7 is replaced with alanine; and
29 the leucine corresponding to position 373 of SEQ ID NO:2 or position 354 of
30 SEQ ID NO:7 is replaced with alanine.

- 1 11. The recombinant host cell of claim 10, wherein SEQ ID NO:2 is modified by the
2 following changes or SEQ ID NO:7 is modified by the following changes:
3 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
4 ID NO:7 is replaced with phenylalanine;
5 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
6 SEQ ID NO:7 is replaced with phenylalanine;
7 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
8 SEQ ID NO:7 is replaced with phenylalanine;
9 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
10 SEQ ID NO:7 is replaced with phenylalanine;
11 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
12 SEQ ID NO:7 is replaced with phenylalanine;
13 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
14 SEQ ID NO:7 is replaced with phenylalanine; and
15 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
16 SEQ ID NO:7 is replaced with phenylalanine.
- 17 12. The recombinant host cell of claim 10, wherein SEQ ID NO:2 is modified by the
18 following changes or SEQ ID NO:7 is modified by the following changes:
19 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
20 SEQ ID NO:7 is replaced with phenylalanine;
21 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
22 SEQ ID NO:7 is replaced with phenylalanine;
23 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
24 SEQ ID NO:7 is replaced with phenylalanine;
25 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
26 SEQ ID NO:7 is replaced with phenylalanine; and
27 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
28 SEQ ID NO:7 is replaced with phenylalanine.
- 29 13. The recombinant host cell of claim 10, wherein the host cell is a bacterial cell.
- 30 14. The recombinant host cell of claim 10, wherein the host cell is a plant cell.

- 1 15. A recombinant plant comprising a structural nucleic acid sequence encoding SEQ
2 ID NO:2 modified in one or more of the following regions, or SEQ ID NO:7
3 modified in one or more of the following regions:
4 positions 104-113 of SEQ ID NO:2 or positions 85-94 of SEQ ID NO:7;
5 positions 128-137 of SEQ ID NO:2 or positions 109-118 of SEQ ID NO:7;
6 positions 184-197 of SEQ ID NO:2 or positions 165-178 of SEQ ID NO:7;
7 position 202 of SEQ ID NO:2 or position 183 of SEQ ID NO:7;
8 positions 264-277 of SEQ ID NO:2 or positions 245-258 of SEQ ID NO:7;
9 positions 316-325 of SEQ ID NO:2 or positions 297-306 of SEQ ID NO:7; and
10 positions 360-377 of SEQ ID NO:2 or positions 341-358 of SEQ ID NO:7;
11 wherein:
12 SEQ ID NO:2 or SEQ ID NO:7 is modified by replacing one or more
13 amino acids in the regions with alanine, glutamic acid,
14 phenylalanine, proline, serine, or glutamine; and
15 the modified protein displays reduced binding to anti- acyl lipid hydrolase
16 antibodies with respect to the binding of unmodified acyl lipid
17 hydrolase protein to the anti- acyl lipid hydrolase antibodies.
- 18 16. A recombinant plant comprising a structural nucleic acid sequence encoding SEQ
19 ID NO:2 modified by one or more of the following changes or encoding SEQ ID
20 NO:7 modified by one or more of the following changes:
21 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
22 ID NO:7 is replaced with phenylalanine or alanine;
23 the isoleucine corresponding to position 113 of SEQ ID NO:2 or position 94 of
24 SEQ ID NO:7 is replaced with alanine;
25 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
26 SEQ ID NO:7 is replaced with phenylalanine or alanine;
27 the lysine corresponding to position 137 of SEQ ID NO:2 or position 118 of SEQ
28 ID NO:7 is replaced with alanine;
29 the serine corresponding to position 184 of SEQ ID NO:2 or position 165 of SEQ
30 ID NO:7 is replaced with alanine;

1 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
2 SEQ ID NO:7 is replaced with phenylalanine or alanine;
3 the alanine corresponding to position 188 of SEQ ID NO:2 or position 169 of
4 SEQ ID NO:7 is replaced with serine;
5 the threonine corresponding to position 192 of SEQ ID NO:2 or position 173 of
6 SEQ ID NO:7 is replaced with alanine or proline;
7 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
8 SEQ ID NO:7 is replaced with phenylalanine or alanine;
9 the asparagine corresponding to position 202 of SEQ ID NO:2 or position 183 of
10 SEQ ID NO:7 is replaced with glutamine;
11 the lysine corresponding to position 268 of SEQ ID NO:2 or position 249 of SEQ
12 ID NO:7 is replaced with alanine or glutamic acid;
13 the threonine corresponding to position 269 of SEQ ID NO:2 or position 250 of
14 SEQ ID NO:7 is replaced with alanine;
15 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
16 SEQ ID NO:7 is replaced with phenylalanine or alanine;
17 the lysine corresponding to position 273 of SEQ ID NO:2 or position 254 of SEQ
18 ID NO:7 is replaced with alanine;
19 the lysine corresponding to position 313 of SEQ ID NO:2 or position 294 of SEQ
20 ID NO:7 is replaced with glutamic acid;
21 the asparagine corresponding to position 314 of SEQ ID NO:2 or position 295 of
22 SEQ ID NO:7 is replaced with alanine;
23 the asparagine corresponding to position 315 of SEQ ID NO:2 or position 296 of
24 SEQ ID NO:7 is replaced with alanine;
25 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
26 SEQ ID NO:7 is replaced with phenylalanine or alanine;
27 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
28 SEQ ID NO:7 is replaced with phenylalanine;
29 the lysine corresponding to position 367 of SEQ ID NO:2 or position 348 of SEQ
30 ID NO:7 is replaced with alanine;

1 the arginine corresponding to position 368 of SEQ ID NO:2 or position 349 of
2 SEQ ID NO:7 is replaced with alanine;
3 the phenylalanine corresponding to position 369 of SEQ ID NO:2 or position 350
4 of SEQ ID NO:7 is replaced with alanine;
5 the lysine corresponding to position 371 of SEQ ID NO:2 or position 352 of SEQ
6 ID NO:7 is replaced with alanine;
7 the leucine corresponding to position 372 of SEQ ID NO:2 or position 353 of
8 SEQ ID NO:7 is replaced with alanine; and
9 the leucine corresponding to position 373 of SEQ ID NO:2 or position 354 of
10 SEQ ID NO:7 is replaced with alanine.

11 17. The recombinant plant of claim 16, wherein SEQ ID NO:2 is modified by the
12 following changes or SEQ ID NO:7 is modified by the following changes:
13 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
14 ID NO:7 is replaced with phenylalanine;
15 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
16 SEQ ID NO:7 is replaced with phenylalanine;
17 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
18 SEQ ID NO:7 is replaced with phenylalanine;
19 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
20 SEQ ID NO:7 is replaced with phenylalanine;
21 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
22 SEQ ID NO:7 is replaced with phenylalanine;
23 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
24 SEQ ID NO:7 is replaced with phenylalanine; and
25 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
26 SEQ ID NO:7 is replaced with phenylalanine.

27 18. The recombinant plant of claim 16, wherein SEQ ID NO:2 is modified by the
28 following changes or SEQ ID NO:7 is modified by the following changes:
29 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
30 SEQ ID NO:7 is replaced with phenylalanine;

1 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
2 SEQ ID NO:7 is replaced with phenylalanine;
3 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
4 SEQ ID NO:7 is replaced with phenylalanine;
5 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
6 SEQ ID NO:7 is replaced with phenylalanine; and
7 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
8 SEQ ID NO:7 is replaced with phenylalanine.

9 19. The recombinant plant of claim 16, wherein the plant is an alfalfa, banana, canola,
10 corn, cotton, cucumber, peanut, potato, rice, soybean, sunflower, sweet potato,
11 tobacco, tomato, or wheat plant.

12 20. A method of preparing a recombinant plant transformed to produce a protein
13 modified to exhibit reduced allergen eliciting properties when consumed in the
14 diet of a human allergic to the unmodified protein, the method comprising:
15 selecting a host plant cell;
16 transforming the host plant cell with a recombinant vector;
17 obtaining recombinant host cells; and
18 regenerating a recombinant plant from the recombinant host plant cells; wherein
19 the recombinant vector comprises a structural nucleic acid sequence
20 encoding SEQ ID NO:2 modified in one or more of the following regions,
21 or SEQ ID NO:7 modified in one or more of the following regions:
22 positions 104-113 of SEQ ID NO:2 or positions 85-94 of SEQ ID NO:7;
23 positions 128-137 of SEQ ID NO:2 or positions 109-118 of SEQ ID NO:7;
24 positions 184-197 of SEQ ID NO:2 or positions 165-178 of SEQ ID NO:7;
25 position 202 of SEQ ID NO:2 or position 183 of SEQ ID NO:7;
26 positions 264-277 of SEQ ID NO:2 or positions 245-258 of SEQ ID NO:7;
27 positions 316-325 of SEQ ID NO:2 or positions 297-306 of SEQ ID NO:7;
28 and
29 positions 360-377 of SEQ ID NO:2 or positions 341-358 of SEQ ID NO:7;
30 wherein:

1 SEQ ID NO:2 or SEQ ID NO:7 is modified by replacing one or more
2 amino acids in the regions with alanine, glutamic acid,
3 phenylalanine, proline, serine, or glutamine; and
4 the modified protein displays reduced binding to anti-acyl lipid hydrolase
5 antibodies with respect to the binding of unmodified acyl lipid
6 hydrolase protein to the anti-acyl lipid hydrolase antibodies.

7 21. A method of preparing a recombinant plant transformed to produce a protein
8 modified to exhibit reduced allergen eliciting properties when consumed in the
9 diet of a human allergic to the unmodified protein, the method comprising:
10 selecting a host plant cell;
11 transforming the host plant cell with a recombinant vector;
12 obtaining recombinant host cells; and
13 regenerating a recombinant plant from the recombinant host plant cells; wherein
14 the recombinant vector comprises a structural nucleic acid sequence
15 encoding SEQ ID NO:2 modified by one or more of the following changes
16 or encoding SEQ ID NO:7 modified by one or more of the following
17 changes:
18 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87
19 of SEQ ID NO:7 is replaced with phenylalanine or alanine;
20 the isoleucine corresponding to position 113 of SEQ ID NO:2 or position
21 94 of SEQ ID NO:7 is replaced with alanine;
22 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position
23 110 of SEQ ID NO:7 is replaced with phenylalanine or alanine;
24 the lysine corresponding to position 137 of SEQ ID NO:2 or position 118
25 of SEQ ID NO:7 is replaced with alanine;
26 the serine corresponding to position 184 of SEQ ID NO:2 or position 165
27 of SEQ ID NO:7 is replaced with alanine;
28 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position
29 166 of SEQ ID NO:7 is replaced with phenylalanine or alanine;
30 the alanine corresponding to position 188 of SEQ ID NO:2 or position 169
31 of SEQ ID NO:7 is replaced with serine;

1 the threonine corresponding to position 192 of SEQ ID NO:2 or position
2 173 of SEQ ID NO:7 is replaced with alanine or proline;
3 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position
4 174 of SEQ ID NO:7 is replaced with phenylalanine or alanine;
5 the asparagine corresponding to position 202 of SEQ ID NO:2 or position
6 183 of SEQ ID NO:7 is replaced with glutamine;
7 the lysine corresponding to position 268 of SEQ ID NO:2 or position 249
8 of SEQ ID NO:7 is replaced with alanine or glutamic acid;
9 the threonine corresponding to position 269 of SEQ ID NO:2 or position
10 250 of SEQ ID NO:7 is replaced with alanine;
11 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position
12 251 of SEQ ID NO:7 is replaced with phenylalanine or alanine;
13 the lysine corresponding to position 273 of SEQ ID NO:2 or position 254
14 of SEQ ID NO:7 is replaced with alanine;
15 the lysine corresponding to position 313 of SEQ ID NO:2 or position 294
16 of SEQ ID NO:7 is replaced with glutamic acid;
17 the asparagine corresponding to position 314 of SEQ ID NO:2 or position
18 295 of SEQ ID NO:7 is replaced with alanine;
19 the asparagine corresponding to position 315 of SEQ ID NO:2 or position
20 296 of SEQ ID NO:7 is replaced with alanine;
21 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position
22 297 of SEQ ID NO:7 is replaced with phenylalanine or alanine;
23 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position
24 343 of SEQ ID NO:7 is replaced with phenylalanine;
25 the lysine corresponding to position 367 of SEQ ID NO:2 or position 348
26 of SEQ ID NO:7 is replaced with alanine;
27 the arginine corresponding to position 368 of SEQ ID NO:2 or position
28 349 of SEQ ID NO:7 is replaced with alanine;
29 the phenylalanine corresponding to position 369 of SEQ ID NO:2 or
30 position 350 of SEQ ID NO:7 is replaced with alanine;

1 the lysine corresponding to position 371 of SEQ ID NO:2 or position 352
2 of SEQ ID NO:7 is replaced with alanine;
3 the leucine corresponding to position 372 of SEQ ID NO:2 or position 353
4 of SEQ ID NO:7 is replaced with alanine; and
5 the leucine corresponding to position 373 of SEQ ID NO:2 or position 354
6 of SEQ ID NO:7 is replaced with alanine.

7 22. The method of claim 21, wherein SEQ ID NO:2 is modified by the following
8 changes or SEQ ID NO:7 is modified by the following changes:
9 the tyrosine corresponding to position 106 of SEQ ID NO:2 or position 87 of SEQ
10 ID NO:7 is replaced with phenylalanine;
11 the tyrosine corresponding to position 129 of SEQ ID NO:2 or position 110 of
12 SEQ ID NO:7 is replaced with phenylalanine;
13 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
14 SEQ ID NO:7 is replaced with phenylalanine;
15 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
16 SEQ ID NO:7 is replaced with phenylalanine;
17 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
18 SEQ ID NO:7 is replaced with phenylalanine;
19 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
20 SEQ ID NO:7 is replaced with phenylalanine; and
21 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
22 SEQ ID NO:7 is replaced with phenylalanine.

23 23. The method of claim 21, wherein SEQ ID NO:2 is modified by the following
24 changes or SEQ ID NO:7 is modified by the following changes:
25 the tyrosine corresponding to position 185 of SEQ ID NO:2 or position 166 of
26 SEQ ID NO:7 is replaced with phenylalanine;
27 the tyrosine corresponding to position 193 of SEQ ID NO:2 or position 174 of
28 SEQ ID NO:7 is replaced with phenylalanine;
29 the tyrosine corresponding to position 270 of SEQ ID NO:2 or position 251 of
30 SEQ ID NO:7 is replaced with phenylalanine;

- 1 the tyrosine corresponding to position 316 of SEQ ID NO:2 or position 297 of
2 SEQ ID NO:7 is replaced with phenylalanine; and
3 the tyrosine corresponding to position 362 of SEQ ID NO:2 or position 343 of
4 SEQ ID NO:7 is replaced with phenylalanine.
- 5 24. The method of claim 21, wherein the plant is an alfalfa, banana, canola, corn,
6 cotton, cucumber, peanut, potato, rice, soybean, sunflower, sweet potato, tobacco,
7 tomato, or wheat plant.
- 8 25. An isolated protein exhibiting acyl lipid hydrolase activity comprising:
9 (amino acids 247-386 of SEQ ID NO:2)-linker-(amino acids 24-246 of SEQ ID
10 NO:2) or (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-
11 268 of SEQ ID NO:2);
12 said -linker- being selected from the group of linkers consisting of Gly-Pro-Gly as
13 set forth in SEQ ID NO:277 and Gly-Gly-Gly-Ser-Gly-Gly-Gly as set
14 forth in SEQ ID NO:276.
- 15 26. The protein of claim 25, consisting of SEQ ID NO:247.
- 16 27. The protein of claim 25, consisting of SEQ ID NO:259.
- 17 28. A recombinant host cell comprising a structural nucleic acid sequence encoding a
18 protein selected from the group consisting of:
19 (amino acids 247-386 of SEQ ID NO:2)-linker-(amino acids 24-246 of SEQ ID
20 NO:2) and (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of
21 SEQ ID NO:2);
22 wherein said linker is selected from the group consisting of SEQ ID NO:277 and
23 SEQ ID NO:276.
- 24 29. A recombinant plant comprising a structural nucleic acid sequence encoding a
25 protein selected from the group consisting of:
26 (amino acids 247-386 of SEQ ID NO:2)-linker-(amino acids 24-246 of SEQ ID
27 NO:2) and (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of
28 SEQ ID NO:2);
29 wherein said linker is selected from the group consisting of SEQ ID NO:277 and
30 SEQ ID NO:276; and
- 31 30. A method of preparing a recombinant host cell, the method comprising:

- 1 selecting a host cell;
2 transforming the host cell with a recombinant vector; and
3 obtaining recombinant host cells; wherein the recombinant vector comprises a
4 structural nucleic acid sequence encoding a protein selected from the
5 group consisting of SEQ ID NO:247 and SEQ ID NO:260.
- 6 31. A method of preparing a recombinant plant, the method comprising:
7 selecting a host plant cell;
8 transforming the host plant cell with a recombinant vector;
9 obtaining recombinant host cells; and
10 regenerating a recombinant plant from the recombinant host plant cells; wherein
11 the recombinant vector comprises a structural nucleic acid sequence
12 encoding a protein selected from the group consisting of SEQ ID NO:274
13 and SEQ ID NO:260.
- 14 32. The method of claim 31, wherein the plant is an alfalfa, banana, canola, corn,
15 cotton, cucumber, peanut, potato, rice, soybean, sunflower, sweet potato, tobacco,
16 tomato, or wheat plant.
- 17 33. An isolated protein comprising:
18 (amino acids 247-386 of SEQ ID NO:2)-linker-(amino acids 24-246 of SEQ ID
19 NO:2) or
20 (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of SEQ ID
21 NO:2); the protein modified by replacing one or more amino acids in the
22 following regions with alanine, glutamic acid, phenylalanine, proline,
23 serine, or glutamine:
24 positions 104-113 of SEQ ID NO:2;
25 positions 128-137 of SEQ ID NO:2;
26 positions 184-197 of SEQ ID NO:2;
27 position 202 of SEQ ID NO:2;
28 positions 264-277 of SEQ ID NO:2;
29 positions 316-325 of SEQ ID NO:2; and
30 positions 360-377 of SEQ ID NO:2;

1 wherein the protein displays reduced binding to anti-acyl lipid hydrolase
2 antibodies with respect to the binding of unmodified acyl lipid hydrolase
3 protein to the anti-acyl lipid hydrolase antibodies; and
4 wherein said linker is selected from the group consisting of SEQ ID NO:277 and
5 SEQ ID NO:276; and
6 34. The protein of claim 33, modified by one or more of the following changes:
7 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
8 phenylalanine or alanine;
9 the isoleucine corresponding to position 113 of SEQ ID NO:2 is replaced with
10 alanine;
11 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
12 phenylalanine or alanine;
13 the lysine corresponding to position 137 of SEQ ID NO:2 is replaced with
14 alanine;
15 the serine corresponding to position 184 of SEQ ID NO:2 is replaced with
16 alanine;
17 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
18 phenylalanine or alanine;
19 the alanine corresponding to position 188 of SEQ ID NO:2 is replaced with
20 serine;
21 the threonine corresponding to position 192 of SEQ ID NO:2 is replaced with
22 alanine or proline;
23 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
24 phenylalanine or alanine;
25 the asparagine corresponding to position 202 of SEQ ID NO:2 is replaced with
26 glutamine;
27 the lysine corresponding to position 268 of SEQ ID NO:2 is replaced with alanine
28 or glutamic acid;
29 the threonine corresponding to position 269 of SEQ ID NO:2 is replaced with
30 alanine;

1 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
2 phenylalanine or alanine;
3 the lysine corresponding to position 273 of SEQ ID NO:2 is replaced with
4 alanine;
5 the lysine corresponding to position 313 of SEQ ID NO:2 is replaced with
6 glutamic acid;
7 the asparagine corresponding to position 314 of SEQ ID NO:2 is replaced with
8 alanine;
9 the asparagine corresponding to position 315 of SEQ ID NO:2 is replaced with
10 alanine;
11 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
12 phenylalanine or alanine;
13 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
14 phenylalanine;
15 the lysine corresponding to position 367 of SEQ ID NO:2 is replaced with
16 alanine;
17 the arginine corresponding to position 368 of SEQ ID NO:2 is replaced with
18 alanine;
19 the phenylalanine corresponding to position 369 of SEQ ID NO:2 is replaced with
20 alanine;
21 the lysine corresponding to position 371 of SEQ ID NO:2 is replaced with
22 alanine;
23 the leucine corresponding to position 372 of SEQ ID NO:2 is replaced with
24 alanine; and
25 the leucine corresponding to position 373 of SEQ ID NO:2 is replaced with
26 alanine.
27 35. The protein of claim 33, wherein:
28 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
29 phenylalanine;
30 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
31 phenylalanine;

- 1 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
2 phenylalanine;
3 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
4 phenylalanine;
5 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
6 phenylalanine;
7 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
8 phenylalanine; and
9 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
10 phenylalanine.
- 11 36. The protein of claim 33, wherein:
12 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
13 phenylalanine;
14 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
15 phenylalanine;
16 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
17 phenylalanine;
18 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
19 phenylalanine; and
20 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
21 phenylalanine.
- 22 37. An isolated nucleic acid molecule segment comprising a structural nucleic acid
23 sequence, the structural nucleic acid sequence encoding a protein selected from
24 the group consisting of (amino acids 247-386 of SEQ ID NO:2)-linker-(amino
25 acids 24-246 of SEQ ID NO:2); and
26 (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of SEQ ID
27 NO:2); the protein modified by replacing one or more amino acids in the
28 following regions with alanine, glutamic acid, phenylalanine, proline, serine, or
29 glutamine:
30 positions 104-113 of SEQ ID NO:2;
31 positions 128-137 of SEQ ID NO:2;

1 positions 184-197 of SEQ ID NO:2;
2 position 202 of SEQ ID NO:2;
3 positions 264-277 of SEQ ID NO:2;
4 positions 316-325 of SEQ ID NO:2; and
5 positions 360-377 of SEQ ID NO:2;
6 wherein the protein displays reduced binding to anti-acyl lipid hydrolase
7 antibodies with respect to the binding of unmodified acyl lipid hydrolase
8 protein to the anti-acyl lipid hydrolase antibodies; and
9 wherein the linker is selected from the group consisting of SEQ ID NO:277 and
10 SEQ ID NO:276; and
11 38. The nucleic acid molecule segment of claim 37, wherein the protein is modified
12 by one or more of the following changes:
13 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
14 phenylalanine or alanine;
15 the isoleucine corresponding to position 113 of SEQ ID NO:2 is replaced with
16 alanine;
17 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
18 phenylalanine or alanine;
19 the lysine corresponding to position 137 of SEQ ID NO:2 is replaced with
20 alanine;
21 the serine corresponding to position 184 of SEQ ID NO:2 is replaced with
22 alanine;
23 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
24 phenylalanine or alanine;
25 the alanine corresponding to position 188 of SEQ ID NO:2 is replaced with
26 serine;
27 the threonine corresponding to position 192 of SEQ ID NO:2 is replaced with
28 alanine or proline;
29 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
30 phenylalanine or alanine;

1 the asparagine corresponding to position 202 of SEQ ID NO:2 is replaced with
2 glutamine;
3 the lysine corresponding to position 268 of SEQ ID NO:2 is replaced with alanine
4 or glutamic acid;
5 the threonine corresponding to position 269 of SEQ ID NO:2 is replaced with
6 alanine;
7 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
8 phenylalanine or alanine;
9 the lysine corresponding to position 273 of SEQ ID NO:2 is replaced with
10 alanine;
11 the lysine corresponding to position 313 of SEQ ID NO:2 is replaced with
12 glutamic acid;
13 the asparagine corresponding to position 314 of SEQ ID NO:2 is replaced with
14 alanine;
15 the asparagine corresponding to position 315 of SEQ ID NO:2 is replaced with
16 alanine;
17 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
18 phenylalanine or alanine;
19 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
20 phenylalanine;
21 the lysine corresponding to position 367 of SEQ ID NO:2 is replaced with
22 alanine;
23 the arginine corresponding to position 368 of SEQ ID NO:2 is replaced with
24 alanine;
25 the phenylalanine corresponding to position 369 of SEQ ID NO:2 is replaced with
26 alanine;
27 the lysine corresponding to position 371 of SEQ ID NO:2 is replaced with
28 alanine;
29 the leucine corresponding to position 372 of SEQ ID NO:2 is replaced with
30 alanine; and

1 the leucine corresponding to position 373 of SEQ ID NO:2 is replaced with
2 alanine.

3 39. The nucleic acid molecule segment of claim 37, wherein:
4 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
5 phenylalanine;
6 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
7 phenylalanine;
8 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
9 phenylalanine;
10 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
11 phenylalanine;
12 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
13 phenylalanine;
14 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
15 phenylalanine; and
16 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
17 phenylalanine.

18 40. The nucleic acid molecule segment of claim 37, wherein:
19 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
20 phenylalanine;
21 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
22 phenylalanine;
23 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
24 phenylalanine;
25 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
26 phenylalanine; and
27 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
28 phenylalanine.

29 41. A recombinant vector comprising operatively linked in the 5' to 3' orientation:
30 a promoter that directs transcription of a structural nucleic acid sequence;

1 a structural nucleic acid sequence encoding a protein selected from the group
2 consisting of (amino acids 247-386 of SEQ ID NO:2)-linker-(amino acids 24-246
3 of SEQ ID NO:2); and
4 (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of SEQ ID
5 NO:2); and
6 a 3' transcription terminator;
7 the protein modified by replacing one or more amino acids in the following
8 regions with alanine, glutamic acid, phenylalanine, proline, serine, or
9 glutamine:
10 positions 104-113 of SEQ ID NO:2;
11 positions 128-137 of SEQ ID NO:2;
12 positions 184-197 of SEQ ID NO:2;
13 position 202 of SEQ ID NO:2;
14 positions 264-277 of SEQ ID NO:2;
15 positions 316-325 of SEQ ID NO:2; and
16 positions 360-377 of SEQ ID NO:2;
17 wherein said linker is selected from the group consisting of SEQ ID NO:277 and
18 SEQ ID NO:276; and
19 wherein the protein displays reduced binding to anti-acyl lipid hydrolase
20 antibodies with respect to the binding of unmodified acyl lipid hydrolase
21 protein to the anti-acyl lipid hydrolase antibodies.
22 42. The recombinant vector of claim 41, wherein the protein is modified by one or
23 more of the following changes:
24 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
25 phenylalanine or alanine;
26 the isoleucine corresponding to position 113 of SEQ ID NO:2 is replaced with
27 alanine;
28 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
29 phenylalanine or alanine;
30 the lysine corresponding to position 137 of SEQ ID NO:2 is replaced with
31 alanine;

1 the serine corresponding to position 184 of SEQ ID NO:2 is replaced with
2 alanine;
3 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
4 phenylalanine or alanine;
5 the alanine corresponding to position 188 of SEQ ID NO:2 is replaced with
6 serine;
7 the threonine corresponding to position 192 of SEQ ID NO:2 is replaced with
8 alanine or proline;
9 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
10 phenylalanine or alanine;
11 the asparagine corresponding to position 202 of SEQ ID NO:2 is replaced with
12 glutamine;
13 the lysine corresponding to position 268 of SEQ ID NO:2 is replaced with alanine
14 or glutamic acid;
15 the threonine corresponding to position 269 of SEQ ID NO:2 is replaced with
16 alanine;
17 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
18 phenylalanine or alanine;
19 the lysine corresponding to position 273 of SEQ ID NO:2 is replaced with
20 alanine;
21 the lysine corresponding to position 313 of SEQ ID NO:2 is replaced with
22 glutamic acid;
23 the asparagine corresponding to position 314 of SEQ ID NO:2 is replaced with
24 alanine;
25 the asparagine corresponding to position 315 of SEQ ID NO:2 is replaced with
26 alanine;
27 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
28 phenylalanine or alanine;
29 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
30 phenylalanine;

1 the lysine corresponding to position 367 of SEQ ID NO:2 is replaced with
2 alanine;
3 the arginine corresponding to position 368 of SEQ ID NO:2 is replaced with
4 alanine;
5 the phenylalanine corresponding to position 369 of SEQ ID NO:2 is replaced with
6 alanine;
7 the lysine corresponding to position 371 of SEQ ID NO:2 is replaced with
8 alanine;
9 the leucine corresponding to position 372 of SEQ ID NO:2 is replaced with
10 alanine; and
11 the leucine corresponding to position 373 of SEQ ID NO:2 is replaced with
12 alanine.

13 43. The recombinant vector of claim 41, wherein:
14 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
15 phenylalanine;
16 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
17 phenylalanine;
18 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
19 phenylalanine;
20 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
21 phenylalanine;
22 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
23 phenylalanine;
24 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
25 phenylalanine; and
26 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
27 phenylalanine.

28 44. The recombinant vector of claim 41, wherein:
29 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
30 phenylalanine;

1 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
2 phenylalanine;
3 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
4 phenylalanine;
5 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
6 phenylalanine; and
7 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
8 phenylalanine.

9 45. A recombinant host cell comprising a structural nucleic acid sequence encoding a
10 protein selected from the group consisting of (amino acids 247-386 of SEQ ID
11 NO:2)-linker-(amino acids 24-246 of SEQ ID NO:2); and
12 (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of SEQ ID
13 NO:2);
14 the protein modified by replacing one or more amino acids in the following
15 regions with alanine, glutamic acid, phenylalanine, proline, serine, or
16 glutamine:
17 positions 104-113 of SEQ ID NO:2;
18 positions 128-137 of SEQ ID NO:2;
19 positions 184-197 of SEQ ID NO:2;
20 position 202 of SEQ ID NO:2;
21 positions 264-277 of SEQ ID NO:2;
22 positions 316-325 of SEQ ID NO:2; and
23 positions 360-377 of SEQ ID NO:2;
24 wherein said linker is selected from the group consisting of SEQ ID NO:277 and
25 SEQ ID NO:276; and
26 wherein the protein displays reduced binding to anti-acyl lipid hydrolase
27 antibodies with respect to the binding of unmodified acyl lipid hydrolase
28 protein to the anti-acyl lipid hydrolase antibodies.

29 46. The recombinant host cell of claim 45, wherein the protein is modified by one or
30 more of the following changes:

1 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
2 phenylalanine or alanine;
3 the isoleucine corresponding to position 113 of SEQ ID NO:2 is replaced with
4 alanine;
5 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
6 phenylalanine or alanine;
7 the lysine corresponding to position 137 of SEQ ID NO:2 is replaced with
8 alanine;
9 the serine corresponding to position 184 of SEQ ID NO:2 is replaced with
10 alanine;
11 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
12 phenylalanine or alanine;
13 the alanine corresponding to position 188 of SEQ ID NO:2 is replaced with
14 serine;
15 the threonine corresponding to position 192 of SEQ ID NO:2 is replaced with
16 alanine or proline;
17 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
18 phenylalanine or alanine;
19 the asparagine corresponding to position 202 of SEQ ID NO:2 is replaced with
20 glutamine;
21 the lysine corresponding to position 268 of SEQ ID NO:2 is replaced with alanine
22 or glutamic acid;
23 the threonine corresponding to position 269 of SEQ ID NO:2 is replaced with
24 alanine;
25 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
26 phenylalanine or alanine;
27 the lysine corresponding to position 273 of SEQ ID NO:2 is replaced with
28 alanine;
29 the lysine corresponding to position 313 of SEQ ID NO:2 is replaced with
30 glutamic acid;

1 the asparagine corresponding to position 314 of SEQ ID NO:2 is replaced with
2 alanine;
3 the asparagine corresponding to position 315 of SEQ ID NO:2 is replaced with
4 alanine;
5 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
6 phenylalanine or alanine;
7 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
8 phenylalanine;
9 the lysine corresponding to position 367 of SEQ ID NO:2 is replaced with
10 alanine;
11 the arginine corresponding to position 368 of SEQ ID NO:2 is replaced with
12 alanine;
13 the phenylalanine corresponding to position 369 of SEQ ID NO:2 is replaced with
14 alanine;
15 the lysine corresponding to position 371 of SEQ ID NO:2 is replaced with
16 alanine;
17 the leucine corresponding to position 372 of SEQ ID NO:2 is replaced with
18 alanine; and
19 the leucine corresponding to position 373 of SEQ ID NO:2 is replaced with
20 alanine.
21 47. The recombinant host cell of claim 45, wherein:
22 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
23 phenylalanine;
24 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
25 phenylalanine;
26 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
27 phenylalanine;
28 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
29 phenylalanine;
30 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
31 phenylalanine;

1 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
2 phenylalanine; and
3 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
4 phenylalanine.

5 48. The recombinant host cell of claim 45, wherein:
6 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
7 phenylalanine;
8 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
9 phenylalanine;
10 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
11 phenylalanine;
12 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
13 phenylalanine; and
14 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
15 phenylalanine.

16 49. A recombinant plant comprising a structural nucleic acid sequence encoding a
17 protein selected from the group consisting of (amino acids 247-386 of SEQ ID
18 NO:2)-linker-(amino acids 24-246 of SEQ ID NO:2); and
19 (amino acids 269-386 of SEQ ID NO:2)-linker-(amino acids 24-268 of SEQ ID
20 NO:2);
21 the protein modified by replacing one or more amino acids in the following
22 regions with alanine, glutamic acid, phenylalanine, proline, serine, or
23 glutamine:
24 positions 104-113 of SEQ ID NO:2;
25 positions 128-137 of SEQ ID NO:2;
26 positions 184-197 of SEQ ID NO:2;
27 position 202 of SEQ ID NO:2;
28 positions 264-277 of SEQ ID NO:2;
29 positions 316-325 of SEQ ID NO:2; and
30 positions 360-377 of SEQ ID NO:2;

1 wherein said linker is selected from the group consisting of SEQ ID NO:277 and
2 SEQ ID NO:276; and
3 wherein the protein displays reduced binding to anti-acyl lipid hydrolase
4 antibodies with respect to the binding of unmodified acyl lipid hydrolase
5 protein to the anti-acyl lipid hydrolase antibodies.

6 50. The recombinant plant of claim 49, wherein the protein is modified by one or
7 more of the following changes:
8 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
9 phenylalanine or alanine;
10 the isoleucine corresponding to position 113 of SEQ ID NO:2 is replaced with
11 alanine;
12 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
13 phenylalanine or alanine;
14 the lysine corresponding to position 137 of SEQ ID NO:2 is replaced with
15 alanine;
16 the serine corresponding to position 184 of SEQ ID NO:2 is replaced with
17 alanine;
18 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
19 phenylalanine or alanine;
20 the alanine corresponding to position 188 of SEQ ID NO:2 is replaced with
21 serine;
22 the threonine corresponding to position 192 of SEQ ID NO:2 is replaced with
23 alanine or proline;
24 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
25 phenylalanine or alanine;
26 the asparagine corresponding to position 202 of SEQ ID NO:2 is replaced with
27 glutamine;
28 the lysine corresponding to position 268 of SEQ ID NO:2 is replaced with alanine
29 or glutamic acid;
30 the threonine corresponding to position 269 of SEQ ID NO:2 is replaced with
31 alanine;

1 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
2 phenylalanine or alanine;
3 the lysine corresponding to position 273 of SEQ ID NO:2 is replaced with
4 alanine;
5 the lysine corresponding to position 313 of SEQ ID NO:2 is replaced with
6 glutamic acid;
7 the asparagine corresponding to position 314 of SEQ ID NO:2 is replaced with
8 alanine;
9 the asparagine corresponding to position 315 of SEQ ID NO:2 is replaced with
10 alanine;
11 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
12 phenylalanine or alanine;
13 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
14 phenylalanine;
15 the lysine corresponding to position 367 of SEQ ID NO:2 is replaced with
16 alanine;
17 the arginine corresponding to position 368 of SEQ ID NO:2 is replaced with
18 alanine;
19 the phenylalanine corresponding to position 369 of SEQ ID NO:2 is replaced with
20 alanine;
21 the lysine corresponding to position 371 of SEQ ID NO:2 is replaced with
22 alanine;
23 the leucine corresponding to position 372 of SEQ ID NO:2 is replaced with
24 alanine; and
25 the leucine corresponding to position 373 of SEQ ID NO:2 is replaced with
26 alanine.
27 51. The recombinant plant of claim 49, wherein:
28 the tyrosine corresponding to position 106 of SEQ ID NO:2 is replaced with
29 phenylalanine;
30 the tyrosine corresponding to position 129 of SEQ ID NO:2 is replaced with
31 phenylalanine;

1 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
2 phenylalanine;
3 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
4 phenylalanine;
5 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
6 phenylalanine;
7 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
8 phenylalanine; and
9 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
10 phenylalanine.

11 52. The recombinant plant of claim 49, wherein:
12 the tyrosine corresponding to position 185 of SEQ ID NO:2 is replaced with
13 phenylalanine;
14 the tyrosine corresponding to position 193 of SEQ ID NO:2 is replaced with
15 phenylalanine;
16 the tyrosine corresponding to position 270 of SEQ ID NO:2 is replaced with
17 phenylalanine;
18 the tyrosine corresponding to position 316 of SEQ ID NO:2 is replaced with
19 phenylalanine; and
20 the tyrosine corresponding to position 362 of SEQ ID NO:2 is replaced with
21 phenylalanine.

22 53. The recombinant plant of claim 49, wherein the plant is an alfalfa, banana, canola,
23 corn, cotton, cucumber, peanut, potato, rice, soybean, sunflower, sweet potato,
24 tobacco, tomato, or wheat plant.

25 54. A method for decreasing allergen eliciting properties of a native protein
26 comprising the steps of:
27 a) identifying a patient exhibiting an allergic sensitivity to said native
28 protein and obtaining serum from said patient;
29 b) exposing synthetic overlapping peptides representative of said native
30 protein to said patient serum to identify peptides exhibiting epitopes
31 which bind IgE present within said patient serum;

- 1 c) producing variant peptides exhibiting alanine scanning or rational
2 scanning amino acid substitutions based on peptides from step (b),
3 wherein said variant peptides exhibit decreased IgE binding compared
4 to peptides from step (b), said amino acid substitutions comprising
5 result effective substitutions;
- 6 d) modifying the amino acid sequence of said native protein to contain one or
7 more of said result effective substitutions; and
- 8 e) isolating and purifying the modified protein comprising one or more result
9 effective amino acid substitutions;
- 10 wherein the modified protein comprising said one or more result effective
11 substitutions exhibits reduced binding of IgE present within said patient serum
12 when compared with said native protein.
- 13 55. The method according to Claim 54 wherein said native protein is selected from
14 the group consisting of SEQ ID NO:6, SEQ ID NO:278, SEQ ID NO:279, SEQ
15 ID NO:280, SEQ ID NO:281, SEQ ID NO:282, SEQ ID NO:284, SEQ ID
16 NO:286, SEQ ID NO:287, SEQ ID NO:288, SEQ ID NO:289, SEQ ID NO:290,
17 SEQ ID NO:291, SEQ ID NO:292, and SEQ ID NO:293.
- 18 56. A method for producing a modified acyl lipid hydrolase protein comprising:
- 19 a) identifying a patient exhibiting an allergic sensitivity to a native form of
20 said hydrolase protein and obtaining serum from said patient;
- 21 b) exposing synthetic overlapping peptides representative of said native
22 protein to said patient serum to identify peptides exhibiting epitopes
23 which bind immunoglobulins present within said patient serum, said
24 immunoglobulins exhibiting a binding specificity for said native
25 protein;
- 26 c) producing variant peptides exhibiting alanine scanning or rational scanning
27 amino acid substitutions based on peptides from step (b), wherein said
28 variant peptides exhibit decreased immunoglobulin binding compared
29 to peptides from step (b), said amino acid substitutions comprising
30 result effective substitutions;

- 1 d) modifying the amino acid sequence of said native protein to contain one or
2 more of said result effective substitutions; and
- 3 e) isolating and purifying the modified protein comprising one or more result
4 effective amino acid substitutions;
- 5 wherein the modified acyl lipid hydrolase protein comprises said one or more
6 result effective substitutions, exhibits reduced binding of immunoglobulins
7 present within said patient serum when compared with said native protein,
8 exhibits lipid acyl hydrolase activity no less than that of the native protein, and
9 exhibits insecticidal activity no less than that of the native protein.
- 10 57. An isolated deallergized acyl lipid hydrolase protein comprising phenylalanine
11 residues substituted for tyrosine residues at one or more amino acid sequence
12 positions corresponding to positions selected from the group consisting of
13 positions 106, 129, 185, 193, 270, and 316 as set forth in SEQ ID NO:2 or the
14 corresponding amino acid sequence positions in acyl lipid hydrolase protein
15 homologs aligned with SEQ ID NO:2 (patatin_mtc) as set forth in Figure 9.
- 16 58. An isolated deallergized acyl lipid hydrolase protein according to Claim 57
17 comprising a glutamine residue substituted for an asparagine residue at an amino
18 acid sequence position selected from the group of amino acid sequence positions
19 consisting of position 202 as set forth in SEQ ID NO:2, position 183 as set forth
20 in SEQ ID NO:7, position 183 as set forth in SEQ ID NO:281, and position 181
21 as set forth in SEQ ID NO:280.
- 22 59. An isolated deallergized acyl lipid hydrolase protein comprising a glutamine
23 residue substituted for an asparagine residue at an amino acid sequence position
24 selected from the group of amino acid sequence positions consisting of position
25 202 as set forth in SEQ ID NO:2, position 183 as set forth in SEQ ID NO:7,
26 position 183 as set forth in SEQ ID NO:281, and position 181 as set forth in SEQ
27 ID NO:280.
- 28 60. An isolated and purified peptide sequence exhibiting corn rootworm insect
29 inhibitory activity and acyl lipid hydrolase activity comprising the peptide
30 sequence as set forth in SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:247, SEQ ID
31 NO:251, SEQ ID NO:255, SEQ ID NO:259, SEQ ID NO:263, SEQ ID NO:265,

1 SEQ ID NO:271, SEQ ID NO:275, SEQ ID NO:278, SEQ ID NO:279, SEQ ID
2 NO:280, SEQ ID NO:281, SEQ ID NO:282, SEQ ID NO:284, SEQ ID NO:286,
3 SEQ ID NO:289, SEQ ID NO:290, SEQ ID NO:291, SEQ ID NO:292, or SEQ ID
4 NO:293.

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